

Description of the larva of *Protanypus* sp. A (Diptera, Chironomidae) from the Italian Alps

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Abstract

We describe the larva of *Protanypus* sp. A from the Italian Alps. All the larval characteristics fit the diagnosis of the genus, but it is impossible to assign the specimens examined to one of the known species. The low number of labral scales (12-14) and the serrated median lamellae of the medioventral appendix of the prementum exclude the identity of the species with *P. morio* or with the East Palaearctic *P. pseudomorio*. The antennal ratio (2.3) excludes the identity with *P. caudatus* or *P. forcipatus*, which are the other two *Protanypus* species known from the Alpine region. In Sæther's key (1975) the larva fits with the Nearctic *P. ramosus*, but identification of the species needs to be supported by pupal and adult material. In the Southern Alps, the genus is restricted to cold lakes at high altitude and is confirmed as an indicator of oligotrophic lakes.

Introduction

Larval material belonging to the genus *Protanypus* was recently col-

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lected in the Southern Alps. The genus is considered to be an indicator of oligotrophic conditions in lakes (Sæther, 1979). There are few records of the genus on the southern side of the Alps and the material collected was never described. The genus is Holarctic in distribution with three species known to occur in Europe, *P. caudatus* Edwards, 1924, *P. forcipatus* (Egger, 1864) and *P. morio* (Zetterstedt, 1838), two species from East Palearctic, *P. pseudomorio* Makarchenko, 1982, also captured in Alaska (Sæther and Willassen, 1985), and *P. tshereshevi* Makarchenko, 1982, three species from North America, *P. ramosus* Sæther, 1975, *P. hamiltoni* Sæther, 1975 and *P. sætheri* Wiederholm, 1975. Two other species were described as larvae (Sæther, 1975; Ashe and O'Connor, 2009). The genus is restricted to cold oligotrophic lakes and is considered an indicator of oligotrophy (Sæther, 1979). The larva was described by Sæther (1975), Doughman (1983), Wiederholm (1983) and Makarchenko (2006).

Materials and methods

Larvae were fixed in 70% ethanol, body parts were dehydrated in acetic acid, butanol, phenol 3: xylene 1 (Wirth and Marston, 1968) and slide-mounted in Canada balsam. The larval head capsule was dissected as described by Wiederholm (1983). Terminology and abbreviations used in the description follow Sæther (1976, 1980). Measurements are according to Sæther (1976) and are given in μm , unless otherwise specified.

Results

Diagnosis

The larvae do not exceed 10 mm in length. The postoccipital margin has only a small ventrolateral, posteriorly directed projection on each side (Figure 1 poc). Antennal ratio is over 2.0, there are 12-14 labral scales (Figure 1 lab), the median tooth of mentum is very large (Figure 1 mnt, prh), and the median lamellae of medio-ventral appendix of prementum serrated (Figure 1 prh). Procerci are approximately 100 μm long.

Description

The description is based on 2 larvae at the 4th stage and 3 larvae at the 3rd stage, collected in Lake Palù (Lombardy, Italy). These are medium-sized, large larva in the 4th stage, approximately 10 mm long. The head capsule is covered with numerous small setae and there is a small ventrolateral projection on its occipital margin on each side. The antenna (Figure 1 ant, Figure 2 ant, Figure 3, Figure

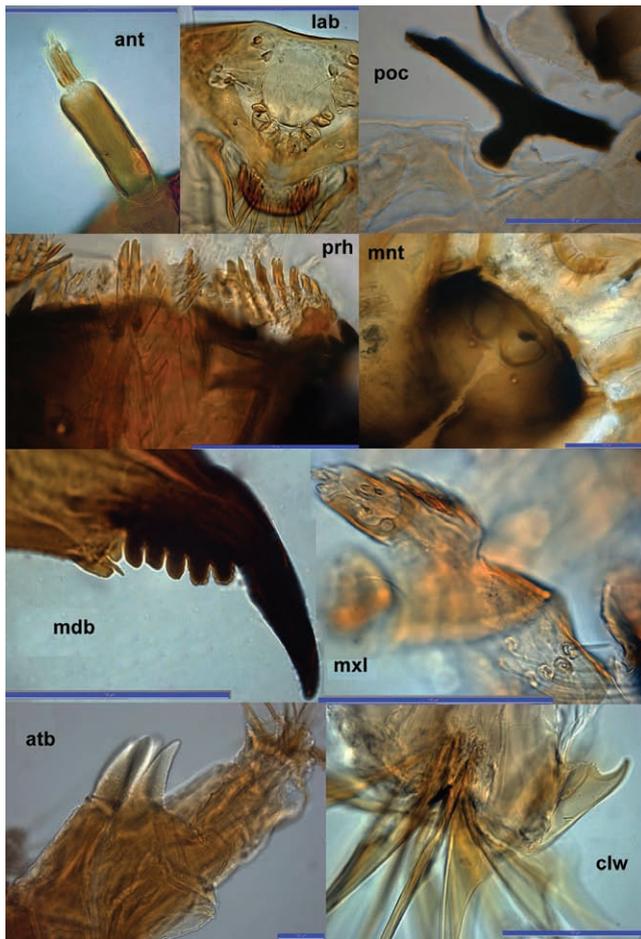


Figure 1. The larva of *Protanypus* sp. A. Ant, antenna; lab, labrum; poc, prolongation of occipital margin of head capsule; mnt, mentum; prh, prementum and hypopharynx; mdb, mandible; mxl, maxilla; atb, anal tubules; clw, claws of posterior prolegs. Blue bar: 100 μ m.

4) has 4 segments. Antennal segments are 78.2, 21.7, 2.7, 6.5 μ m long. Antennal ratio (AR) is 2.26: 1st segment is very long, 2nd is shorter, 3rd segment is very short, 4th segment is much longer than the 3rd. The antennal blade is 26 μ m long, accessory blade 23 μ m, style 5.6 μ m, Lauterborn organ 8.9 μ m. The ring organ near the base of antenna is only 13 μ m from the base and approximately 62 μ m from the distal margin of the first antennal segment. All S setae of the labrum (Figure 1 lab, Figure 5, Figure 6) are short and simple. There are approximately 12-14 labral scales. These are broad, leaf-like, circular, apically serrated, overlapping, and disposed in a semicircular row. There are no lateral chaetae, pecten epipharyngis consists of 3 large scales, pointed at the apex, continuous with chaetae laterals. There is a narrow premandible with a well-developed, but very slender inner tooth. The other 2 teeth are very small and difficult to see. The mandible (Figure 1 mdb, Figure 2 mdb) has 5 inner teeth and a very long slender apical tooth. The seta subdentalis is pointed and narrow. There are no seta interna. The mentum (Figure 1 mnt, prh, Figure 2 mnt, MApp, PH) has a very large transparent median tooth. The width of the whole mentum is 142 μ m. Two to three lateral teeth are restricted to the extreme lateral region (Figure 2 PH). Ventromental plates are present but not developed (Figure 2 PH). The supporting endoskeleton is 190 μ m wide. The medio-ventral appendix M (Figure 2 MApp) is 12.6 μ m at its narrowest point, 38.7 μ m at its base, with median lamellae serrated at its apex. The ratio of supporting

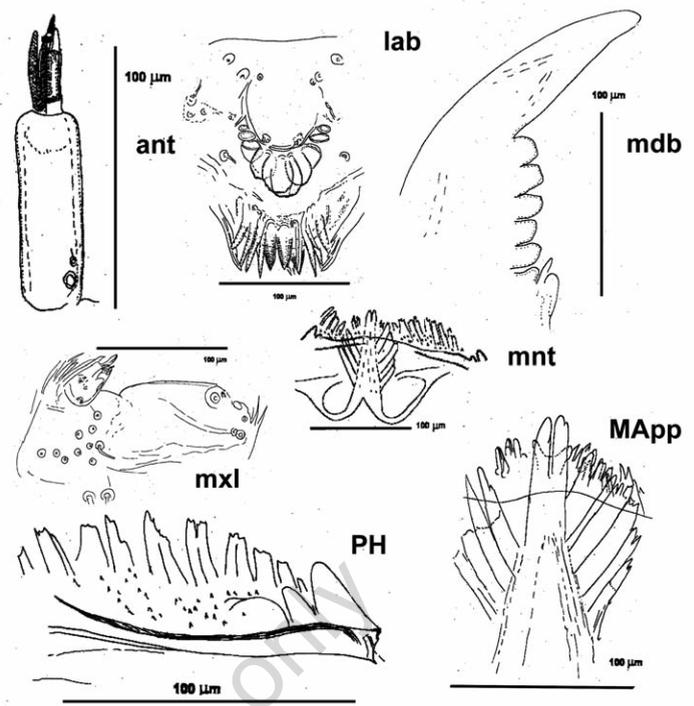


Figure 2. The larva of *Protanypus* sp. A. Ant, antenna; lab, labrum; mdb, mandible; mxl, maxilla; mnt, mentum; MApp, median appendage of prementum; PH, margin of mentum and pecten hypopharyngis.

endoskeleton to median tooth of mentum is approximately 1.4. The ratio of the medio-ventral appendix of prementum is 3.1 at its base to its minimum width. The pecten hypopharyngis has well-developed scales (Figure 1 prh, Figure 2 PH). Maxilla (Figure 1 mxl, Figure 2 mxl): palp is longer than it is wide, and there are numerous setae maxillaris. The anal tubules of the body are triangular (Figure 1 atb) with long narrow claws on the anterior and posterior parapods. There are few claws with small denticles (Figure 1 clw) on the posterior parapods. The procerci are approximately 100 μ m long with 5 setae at the apex. The larvae described here were collected in Lake Palù, Sondrio, Lombardy, Italy (lat. 46°17'59" 5127957.30 WGS/84 UTM 32N; long. 9°52'06" 567045.75 WGS/84 UTM 32N) on 2 August 2011 (depth 6m, water temperature 13°C, oxygen saturation 90%) and on 2 September 2011 at the same station. Previous records of the genus from the southern side of the Alps are from the lakes Laiozza (19/9/1991) and Zota (19/9/1991) in the Lavizzara Valley, river basin of Maggia, one of the tributaries of the River Ticino (Switzerland), and from the lakes Paione Medio and Superiore (13/9/2000) in the Ossola Valley, river basin of the Bognanco (tributary of the River Toce), Verbania, Piedmont, Italy. The genus is also known from the northern side of the Alps from Lake Constance (Reiss, 1968), and from southern Germany and the Austrian lakes (Faaker See, 11/6/2008 and Vorderlang See, 25/6/2008) (Free *et al.*, 2009).

Discussion

The species will be keyed to the Nearctic *P. ramosus* using the key of Sæther (1975). The previous reports of the genus *Protanypus* in Italy can be confirmed in the generic diagnosis, but the citation of *P. caudatus* (Boorman *et al.*, 1995) cannot be confirmed on the basis of larval material; the AR is over 2.0, and this value is only reported for



Figure 3. Antenna: the four antennal segments with antennal blade, accessory blade and ring organ.

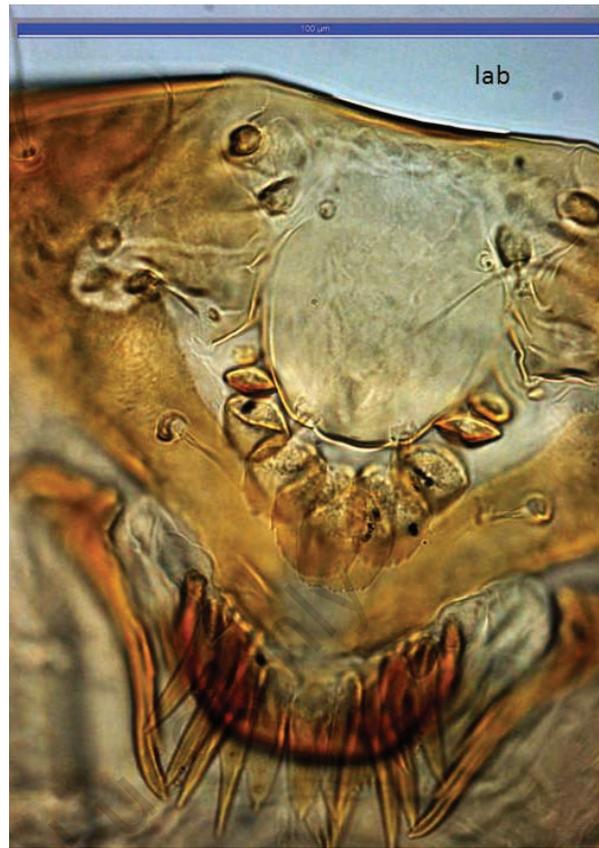


Figure 5. Labrum: labral scales, epipharynx, premandibles.

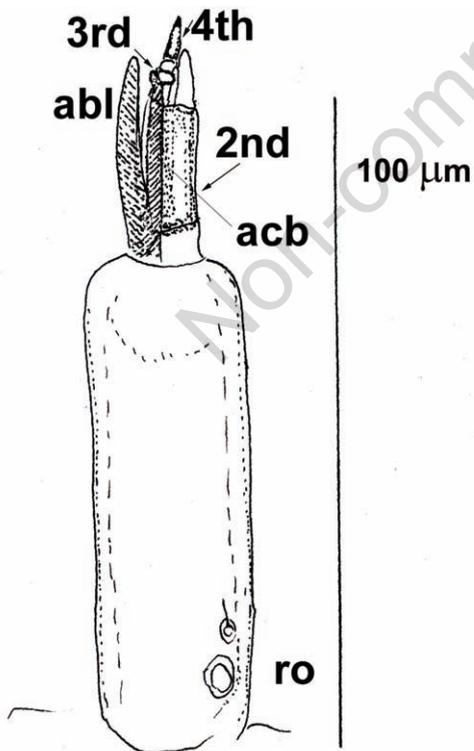


Figure 4. Antenna: abl, antennal blade; acb, accessory blade; ro, ring organ; 2nd, 3rd, 4th, second, third and fourth antennal segments.

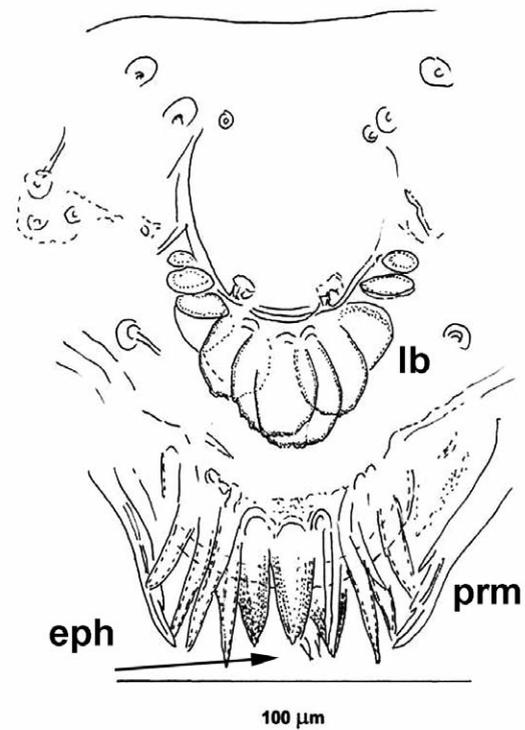


Figure 6. Labrum: lb, labral scales; prm, premandibles; eph, pecten epipharyngis.

Nearctic material. The genus is well described and documented in the adult and in the pupal stages (Brundin, 1952; Wiederholm, 1975; Makarchenko, 1982; Sæther and Willassen, 1985). A short description of the genus in the larval stage has been given by Wiederholm (1983). Different species of the genus have been described by Zavrel (1926), Hirvenoja (1973), Sæther (1975), Doughman (1983) and Makarchenko (2006). Unfortunately, Makarchenko's description of *P. caudatus* (2006) does not agree with the description of Sæther (1975) because the first author described the species as having 16-20 labral scales, while Sæther reports that the species has no more than 12 labral scales. Also other characteristics, such as the premandible, do not help identify the species; *Protanypus* sp. A has a premandible with 3 teeth, like the *P. caudatus* (Makarchenko, 2006). *P. pseudomorio* has a premandible with 5 teeth. The ratio between the medioventral appendix of the prementum, the minimum width at its base and between the supporting endoskeleton of the appendix, and the median tooth width of the mentum were used as characteristics to distinguish between species (Sæther, 1975). However, these criteria are difficult to apply, and it must be emphasized that many morphometric characteristics change with larval size.

Conclusions

The larvae of *Protanypus* can easily be identified to genus but the species determination within the genus according to morphometric measurements is still highly problematic since these depend on larval size. In this case, unless pupae and adults are examined the species should not be named. Attempts are now being made to identify larvae using molecular markers (Willassen, 2011). Preliminary results require confirmation because of the modest levels of phylogenetic signal obtained with low credibility of some nodes. From an ecological point of view, all samples of the genus captured come from high altitude oligotrophic lakes, over 1900 m. The larvae are free living and predatory. In the Alps, they have been reported to be limited to the profundal zone, but our samples were taken at a depth of 6 m.

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